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27195 7590 04/12/2007 AMIN. TUROCY & CALVIN, LLP 24TH FLOOR, NATIONAL CITY CENTER 1900 EAST NINTH STREET CLEVELAND, OH 44114			EXAMINER KHAKHAR, NIRAV K	
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Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/803,443

Applicant(s)

BARRERA ET AL.

Examiner

Nirav K. Khakhar

Art Unit

2167

– The MAILING DATE of this communication appears on the cover sheet with the correspondence address –

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-40 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-40 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 6/21/04, 5/26/05, 9/19/05.

- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: ____.

DETAILED ACTION

Claim Objections

1. **Claim 17** is objected to because of the following informalities: The grammar used in the claim makes it unclear exactly what is being claimed. For purposes of examination, the claim language will be interpreted as follows:

"The system of claim 10, further comprising a classifier that facilitates automating one or more features by making an inference based on one or more parameters related to at least one of a cost-based evaluation, cardinality estimation, and complexity of the query."

Appropriate correction is required.

Claim Rejections - 35 U.S.C. § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. §112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 36 is rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

4. **Claim 36** recites the limitation "the exploratory rule". There is insufficient antecedent basis for this limitation in the claim, in that there is no indication of any exploratory rule in claim 34, the claim from which claim 36 depends.

Claim Rejections - 35 U.S.C. § 101

1. 35 U.S.C. § 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

2. Claims 1 – 40 are rejected under 35 U.S.C. § 101 because the claimed invention is directed to non-statutory subject matter.

As to **Claims 1 – 20 and 34 – 40**, the claimed invention recites a system that facilitates query optimization in a data repository. As per the Detailed Description, page 4, lines 1 – 3, “. . . the term[] ‘system’ [is] intended to refer to a computer-related entity, either hardware, a combination of hardware and software, *software, or software in execution*” (emphasis added). According to this definition, the systems recited in independent claims 1, 10, and 34 could reasonably be construed as merely software. The claims that depend from independent claims 1, 10 and 34 do not add any limitations that would overcome this rejection.

For that reason, the claims lack the necessary physical articles or objects to constitute a machine or a manufacture within the meaning of 35 USC 101. They are clearly not a series of steps or acts to be a process nor are they a combination of chemical compounds to be a composition of matter. As such, they fail to fall within a statutory category. They are, at best, functional descriptive material per se.

Descriptive material can be characterized as either “functional descriptive material” or “nonfunctional descriptive material.” Both types of “descriptive material” are nonstatutory when claimed as descriptive material per se, 33 F.3d at 1360, 31 USPQ2d at 1759. When functional descriptive material is recorded on some computer-readable medium, it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized. Compare *In re Lowry*, 32 F.3d 1579, 1583-84, 32 USPQ2d 1031, 1035 (Fed. Cir. 1994)

Merely claiming nonfunctional descriptive material, i.e., abstract ideas, stored on a computer-readable medium, in a computer, or on an electromagnetic carrier signal, does not make it statutory. See *Diehr*, 450 U.S. at 185-86, 209 USPQ at 8 (noting that the claims for an algorithm in *Benson* were unpatentable as abstract ideas because “[t]he sole practical application of the algorithm was in connection with the programming of a general purpose computer.”).

As to **Claims 21 and 34**, these claims recite the limitation of analyzing search results for a best solution. The analysis of results, by itself, is not tangible, unless the analysis or an indication of such analysis is stored in memory,

communicated to the user, or outputted on some tangible medium, for example, printer, user display, etc.

As to **Claims 22 – 33 and 35 – 40**, these claims do not add any limitations that overcome the rejection stated above, and are therefore also rejected.

In the interests of compact prosecution, examiner applies prior art rejection to these claims as best understood, with the assumption that Applicant will amend the claims to overcome the rejections stated above.

Claim Rejections - 35 U.S.C. § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. § 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1, 6, and 9 are rejected under 35 U.S.C. § 102(b) as being anticipated by Levy, et al., U.S. Pat. No. 6,088,524 (hereafter, "Levy").

As to **Claim 1**, Levy discloses: a system that facilitates query optimization in a data repository, comprising: a query component that receives a query to be processed against data of the data repository, which query includes an original predicate (Levy, col. 1, lines 28 – 36); and a predicate component that processes

the original predicate into one or more new predicates that include an implied predicate, the implied predicate processed against the data to return a best solution such that a total evaluation cost is significantly reduced (Levy, col. 5, lines 14 – 24).

As to **Claim 6**, Levy discloses: the one or more new predicates being considered cost-based alternatives that are utilized only if the evaluation cost is reduced, otherwise, they are discarded (Levy, Fig. 9).

As to **Claim 9**, Levy discloses: a data repository optimizer according to the system of claim 1 (Levy, col. 6, lines 53 – 67).

Claim Rejections - 35 U.S.C. § 103

5. The following is a quotation of 35 U.S.C. § 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claim 2 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Levy, as applied to Claim 1, in view of Larson, et al., U.S. Pat. No. 6,381,616 (hereafter, "Larson '616").

Levy discloses the limitations of claim for the reasons given above.

As to **Claim 2**, Levy differs from the present invention in that it does not appear to explicitly disclose the limitation of predicate component processing the original predicate to obtain an equivalent predicate.

Larson '616 discloses: predicate component processing the original predicate to obtain an equivalent predicate (Larson '616, col. 11, lines 13 – 17, allowing the query processor to obtain from the query the same results that would have been returned had the query not been optimized).

Levy and Larson '616 are both in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy and Larson '616 before him/her, to have modified the system of Levy with the equivalent predicates of Larson '616, in order to obtain from the query the same results that would have been returned had the query not been optimized.

7. Claims 3 – 5, and 7 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Levy, as applied to Claim 1, in view of Larson, et al., U.S. PG-Pub. No. 2003/0093415 (hereafter, "Larson '415").

Levy discloses the limitations of claim 1 for the reasons given above.

As to **Claim 3**, Levy differs from the present invention in that it does not appear to explicitly disclose the limitation of: the predicate component processing the original predicate to obtain a residual predicate.

Larson '415 discloses: the predicate component processing the original predicate to obtain a residual predicate (Larson '415, [0089], ensuring that unused predicates are maintained).

Levy and Larson '415 are both in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy and Larson '415 before him/her, to have modified the system of Levy with the residual predicates of Larson '415, in order to ensure that unused predicates are maintained in the query processing.

As to **Claim 4**, Levy differs from the present invention in that it does not appear to explicitly disclose the limitation of: the query being a previously processed query that is unmatched.

Larson '415 discloses: the query being a previously processed query that is unmatched (Larson '415, [0089], ensuring that unused predicates are maintained).

Levy and Larson '415 are both in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy and Larson '415 before him/her, to have modified the system of Levy with the residual predicates of Larson '415, in order to ensure that unused predicates are maintained in the query processing.

As to **Claim 5**, Levy differs from the present invention in that it does not appear to explicitly disclose the limitation of: the one or more new predicates able to be used for standard indices and multi-valued indices.

Larson '415 discloses: the one or more new predicates able to be used for standard indices and multi-valued indices (Larson '415, [0134], allowing a newly created predicate to be used for building and searching a lattice index).

Levy and Larson '415 are both in the related art of query optimization.

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It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy and Larson '415 before him, to have modified the system of Levy with the standard and multi-valued index use of Larson '415, in order to allow a newly created predicate to be used for building and searching a lattice index.

As to **Claim 7**, Levy differs from the present invention in that it does not appear to explicitly disclose the limitation of: the one or more new predicates being associated with index utilization.

Larson '415 discloses: the one or more new predicates being associated with index utilization (Larson '415, [0134], allowing a newly created predicate to be used for building and searching a lattice index).

Levy and Larson '415 are both in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy and Larson '415 before him, to have modified the system of Levy with the standard and multi-valued index use of Larson '415, in order to allow a newly created predicate to be used for building and searching a lattice index.

8. Claim 8 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Levy, as applied to Claim 1, in view of Dessloch, et al., U.S. Pat. No. 6,338,056 (hereafter, "Dessloch").

As to **Claim 8**, Levy differs from the present invention in that it does not appear to explicitly disclose the limitation of the query being processed against a data type that is a non-indexable type.

Dessloch discloses: the query being processed against a data type that is a non-indexable type (Dessloch, col. 13, lines 47 – 56, allowing data types that are not indexable to be indexed and queried).

Levy and Dessloch are both in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy and Dessloch before him/her, to have modified the system of Levy with the type-indexability of Dessloch, in order to make non-indexable data types indexable and able to be queried.

9. Claims 10 – 15 and 17 - 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Levy, in view of Larson '616, and Larson '415.

As to **Claim 10**, Levy discloses: a system that facilitates query optimization in a data repository, comprising: a query component that receives a query to be processed against data of the data repository, which query includes an original predicate (Levy, col. 1, lines 28 – 36); and a predicate component that processes the original predicate into one or more new predicates that include an implied predicate, the implied predicate is processed against the data to return a best solution such that a total evaluation cost is significantly reduced (Levy, col. 5, lines 14 – 24).

Levy differs from the present invention in that it does not appear to explicitly disclose the limitations of the predicate component processing the original predicate in to one or more new predicates that include an equivalent predicate and a residual predicate, the equivalent predicate being processed against the data to return a best solution such that a total evaluation cost is significantly reduced.

Larson '616 discloses: the predicate component processing the original predicate in to one or more new predicates that include an equivalent predicate, the equivalent predicate being processed against the data to return a best solution such that a total evaluation cost is significantly reduced (Larson '616, col. 11, lines 13 – 17).

Larson '616 differs from the present invention in that it does not appear to explicitly disclose the limitation of the predicate component processing the original predicate in to one or more new predicates that include a residual predicate.

Larson '415 discloses: the predicate component processing the original predicate in to one or more new predicates that include a residual predicate (Larson '415, [0089]).

Levy, Larson '616 and Larson '415 are all in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy, Larson '616, and Larson '415 before him/her, to have modified the system of Levy with the equivalent predicates and residual predicates of Larson '616 and Larson '415 (respectively), in order to allow the query processor to obtain from the query the same results that would have been returned had the query not been optimized and to ensure that unused predicates are maintained in the query processing.

As to **Claim 11**, Levy, as modified, discloses the implied predicate and the equivalent predicate being considered cost-based alternatives that are discarded if the evaluation cost is not reduced (Levy, Fig. 9).

As to **Claim 12**, Levy, as modified, discloses: a computer readable medium, having stored thereon computer executable instructions for carrying out the system of claim 10 (Larson '415, Fig. 1).

As to **Claim 13**, Levy, as modified, discloses: a server that employs the system of claim 10 (Larson '616, col. 6, lines 56 – 67).

As to **Claim 14**, Levy, as modified, discloses: the predicate component generating an expression using the one or more new predicates, which expression is used to obtain an implication rule that is associated with at least one of a given column and a function on a given column (Larson '415, [0042]).

As to **Claim 15**, Levy, as modified, discloses: the predicate component requesting the implication rule in response to providing the expression to which at least one of the given column and the function on a given column is to be compared, and a list of standard indices that can be exploited (Larson '415, [0042]).

As to **Claim 17**, Levy, as modified, discloses: a classifier that facilitates automating one or more features by making an inference based on one or more

parameters related to at least one of a cost-based evaluation, cardinality estimation, and complexity of the query (Levy, Fig. 9).

As to **Claim 18**, Levy, as modified, discloses: the total evaluation cost includes employing the one or more new predicates only if optimization is increased (Levy, Fig. 9).

10. Claims 16 and 20 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Levy, Larson '616, and Larson '415, as applied to claim 10 above, and further in view of Reiner, et al., U.S. Pat. No. 5,742,806 (hereafter, "Reiner").

As to **Claim 16**, Levy, as modified, discloses the limitations of Claim 10 for the reasons given above.

Levy, as modified, differs from the present invention in that it does not appear to explicitly disclose the limitation of the one or more new predicates being analyzed during index selection.

Reiner discloses: the one or more new predicates being analyzed during index selection (Reiner, col. 98, lines 41 – 53, increasing efficiency if more than one index is available for the query).

Levy, Larson '616, Larson '415, and Reiner are all in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy, Larson '616, Larson '415, and Reiner before him/her, to have further modified the system of Levy with the timing of predicate analysis of Reiner, in order to increase efficiency in the event that a plurality of indices are available to the query.

As to **Claim 20**, Levy, as modified, differs from the present invention in that it does not appear to explicitly disclose the limitation of: the implied predicate exactly matching an index key.

Reiner discloses: the implied predicate exactly matching an index key (Reiner, col. 43, increasing the usefulness of the new predicate).

Levy, Larson '616, Larson '415, and Reiner are all in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy, Larson '616, Larson '415, and Reiner

before him/her, to have further modified the system of Levy with the predicate-key matching of Reiner, in order to increase the usefulness of the new predicate.

11. Claim 19 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Levy, Larson '616 and Larson '415, as applied to claim 10 above, and further in view of Lin, et al., U.S. Pat. No. 6,675,159 (hereafter, "Lin").

As to **Claim 19**, Levy, as modified, discloses the limitations of Claim 10 for the reasons given above.

Levy, as modified, does not appear to explicitly disclose the limitation of: the query being one for which there is no exact match between search predicates and index keys.

Lin discloses: the query being one for which there is no exact match between search predicates and index keys (Lin, col. 21, lines 19 – 21, increasing versatility of the query optimizer).

Levy, Larson '616, Larson '415, and Lin are all in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy, Larson '616, Larson '415, and Lin before him/her, to have further modified the system of Levy with the query attributes of Lin, in order to increase the versatility of the query optimizer.

12. Claim 21 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Levy, in view of Larson '616 and Lin.

As to **Claim 21**, Levy discloses: a computer-readable medium having computer-executable instructions for performing a method for optimizing a search query (Levy, col. 6, lines 53 – 67), the method comprising: reducing the original predicate into at least an implied predicate (Levy, col. 5, lines 14 – 24); processing the implied predicate against data of a data repository to obtain search results (Levy, Fig. 4); and analyzing the search results for a best solution (Levy, Fig. 9).

Levy differs from the present invention in that it does not appear to explicitly disclose the limitations of: receiving a query for whose original predicate there is no exact match to an index key; reducing the original predicate into an equivalent predicate, or processing the equivalent predicate against data of a data repository to obtain search results.

Lin discloses: receiving a query for whose original predicate there is no exact match to an index key (in, col. 21, lines 19 – 21, increasing versatility of the query optimizer).

Lin differs from the present invention in that it does not appear to explicitly disclose the limitations of: reducing the original predicate into an equivalent predicate, or processing the equivalent predicate against data of a data repository to obtain search results.

Larson '616 discloses: reducing the original predicate into an equivalent predicate, or processing the equivalent predicate against data of a data repository to obtain search results (Larson '616, col. 11, lines 13 – 17, allowing the query processor to obtain from the query the same results that would have been returned had the query not been optimized).

Levy, Lin, and Larson '616 are all in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy, Lin, and Larson '616 before him/her to have modified the system of Levy with the lack of exact matching of Lin and the equivalent predicates of Larson '616, in order to increase the versatility of the

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query optimizer, and to allow the query processor to obtain from the query the same results that would have been returned had the query not been optimized.

As to Claim 31, Levy, as modified, discloses: replacing the original predicate with the equivalent predicate and searching for the best solution (Larson '616, Larson '616, col. 11, lines 13 – 17).

13. Claims 22 – 24, 28, 29, 34, 38, and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Levy, Larson '616, and Lin, as applied to Claim 21 above, further in view of Larson '415.

Levy, as modified, discloses the limitations of Claim 21 for the reasons given above.

As to **Claim 22**, Levy, as modified, differs from the present invention in that it does not appear to explicitly disclose the limitation of: requesting an implication rule for a column or function on a column.

Larson '415 discloses: requesting an implication rule for a column or function on a column (Larson '415, [0042], increasing the accuracy of the new predicate).

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Levy, Larson '616, Lin, and Larson '415 are all in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy, Larson '616, Lin, and Larson '415 before him/her, to have further modified the system of Levy with the column-based rule request of Larson '415, in order to increase the accuracy of the new predicate.

As to **Claim 23**, Levy, as modified, differs from the present invention in that it does not appear to explicitly disclose transmitting at least one of an expression to which a column or function on a column is to be compared and a list of standard indices or multi-valued indices that could be exploited.

Larson '415 discloses: transmitting at least one of an expression to which a column or function on a column is to be compared and a list of standard indices or multi-valued indices that could be exploited (Larson '415, [0042], increasing the accuracy of the new predicate).

Levy, Larson '616, Lin, and Larson '415 are all in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy, Larson '616, Lin, and Larson '415 before him/her, to have further modified the system of Levy with the column-based rule request of Larson '415, in order to increase the accuracy of the new predicate.

As to **Claim 24**, Levy, as modified, discloses removing the implied predicate if the implied predicate does not meet certain requirements (Levy, Fig. 9).

Levy, as modified, differs from the present invention in that it does not appear to explicitly disclose the limitation of: the said requirements being the exploitation of one of the standard or multi-value indices.

Larson '415 discloses: the said requirements being the exploitation of one of the standard or multi-value indices (Larson '415, [0042], increasing the accuracy of the new predicate).

Levy, Larson '616, Lin, and Larson '415 are all in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy, Larson '616, Lin, and Larson '415

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before him/her, to have further modified the system of Levy with the column-based rule request of Larson '415, in order to increase the accuracy of the new predicate.

As to **Claim 28**, Levy, as modified, differs from the present invention in that it does not appear to explicitly disclose the limitation of: processing the original predicate to generate a residual predicate that refines the search.

Larson '415 discloses: processing the original predicate to generate a residual predicate that refines the search (Larson '415, [0089], ensuring that unused predicates are maintained).

Levy, Larson '616, Lin, and Larson '415 are all in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy, Larson '616, Lin, and Larson '415 before him/her, to have further modified the system of Levy with the residual predicates of Larson '415, to ensure that unused predicates are maintained.

As to **Claim 29**, Levy, as modified, differs from the present invention in that it does not appear to explicitly disclose the limitation of: processing the residual

predicate after the act of processing at least one of the implied predicate and the equivalent predicate.

Larson '415 discloses: processing the residual predicate after the act of processing at least one of the implied predicate and the equivalent predicate (Larson '415, [0089], ensuring that unused predicates are maintained).

Levy, Larson '616, Lin, and Larson '415 are all in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy, Larson '616, Lin, and Larson '415 before him/her, to have further modified the system of Levy with the residual predicates of Larson '415, to ensure that unused predicates are maintained.

As to **Claim 34**, Levy discloses: a system that facilitates query optimization in a data repository; comprising: means for reducing the original predicate into an implied predicate (Levy, col. 5, lines 14 – 24); means for processing the implied predicate against data of a data repository to obtain search results (Levy, Fig. 4); means for analyzing the search results for a best solution (Levy, Fig. 9); and means for removing the implied predicate if it does not meet certain requirements (Levy, Fig. 9).

Levy differs from the present invention in that it does not appear to explicitly disclose the limitations of: means for receiving a query for whose original predicate there is no exact match to an index key; means for reducing the original predicate into an equivalent predicate; means for requesting an implication rule for a column or function on a column; means for transmitting at least one of an expression to which a column or function on a column is to be compared and a list of standard indices or multi-valued indices that could be exploited; means for processing the equivalent predicate against data of a data repository to obtain search results; or the said requirements for removing the implied predicate being exploitation of one of the standard or multi-value indices.

Larson '415 discloses: means for requesting an implication rule for a column or function on a column (Larson '415, [0042]); means for transmitting at least one of an expression to which a column or function on a column is to be compared and a list of standard indices or multi-valued indices that could be exploited (Larson '415, [0042]); and the said requirements for removing the implied predicate being exploitation of one of the standard or multi-value indices (Larson '415, [0042], all of which increase the accuracy of the new predicate).

Larson '415 differs from the present invention in that it does not appear to explicitly disclose the limitations of: means for receiving a query for whose

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original predicate there is no exact match to an index key; means for reducing the original predicate into an equivalent predicate; or means for processing the equivalent predicate against data of a data repository to obtain search results.

Larson '616 discloses: means for reducing the original predicate into an equivalent predicate (Larson '616, Larson '616, col. 11, lines 13 – 17); and means for processing the equivalent predicate against data of a data repository to obtain search results (Larson '616, col. 11, lines 13 – 17, allowing the query processor to obtain from the query the same results that would have been returned had the query not been optimized).

Larson '616 differs from the present invention in that it does not appear to explicitly disclose the limitation of: means for receiving a query for whose original predicate there is no exact match to an index key.

Lin discloses: means for receiving a query for whose original predicate there is no exact match to an index key (Lin, Lin, col. 21, lines 19 – 21, increasing versatility of the query optimizer).

Levy, Larson '415, Larson '616, and Lin are all in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy, Larson '415, Larson '616, and Lin before him/her, to have modified the system of Levy with the column functions and multi-valued indices of Larson '415, the equivalent predicates of Larson '616; and the lack of exact matching from Lin, in order to increase the accuracy of the new predicate, allow the query processor to obtain from the query the same results that would have been returned had the query not been optimized; and to increase the versatility of the query optimizer.

As to **Claim 38**, Levy, as modified by Larson '415, Larson '616, and Lin, discloses: means for processing the original predicate to generate a residual predicate that refines the search (Larson '415, [0089]).

As to **Claim 39**, Levy, as modified by Larson '415, Larson '616, and Lin, discloses: means for processing the residual predicate after processing at least one of the implied predicate and the equivalent predicate (Larson '415, [0089]).

14. Claims 25 and 26 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Levy, in view of Larson '616 and Lin, as applied to Claim 21, and further in view of Pauschine, et al., U.S. Pat. No. 5,918,232 (hereafter, "Pauschine").

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Levy, Larson '616, and Lin disclose the limitations of Claim 21 for the reasons given above.

As to **Claim 25**, Levy, as modified, differs from the present invention in that it does not appear to explicitly disclose the limitation of: employing a new ad-hoc exploratory rule for an individual operator of the original predicate.

Pauschine discloses: employing a new ad-hoc exploratory rule for an individual operator of the original predicate (Pauschine, col. 18, lines 58 – 67, enabling versatility of rules and predicates).

Levy, Larson '616, Lin, and Pauschine are all in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy, Larson '616, Lin, and Pauschine before him/her, to have further modified the system of Levy with the employment of ad-hoc rules from Pauschine, in order to enable versatility of rules and predicates.

As to **Claim 26**, Levy, as modified by Larson '616, Lin, and Pauschine, discloses: analyzing at least one of the implied predicate and the equivalent predicate with the exploratory rule (Pauschine, col. 18, lines 58 – 67).

15. Claims 27 and 30 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Levy, in view of Larson '616 and Lin, as applied to Claim 21, and further in view of Paulley, et al., U.S. Pat. No. 6,665,664 (hereafter, "Paulley").

Levy, Larson '616, and Lin disclose the limitations of Claim 21 for the reasons given above.

As to **Claim 27**, Levy, as modified, differs from the present invention in that it does not appear to explicitly disclose the limitations of: requesting a list of tentative substitutes with predicates that involve nested queries; including the substitutes into the query to form a new expression; simplifying the new expression; removing nested queries; or generating new alternatives for the search.

Paulley discloses: requesting a list of tentative substitutes with predicates that involve nested queries (Paulley, col. 13, lines 1 – 13); including the substitutes into the query to form a new expression; simplifying the new expression (Paulley, col. 13, lines 1 – 13); removing nested queries; and generating new alternatives

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for the search (Paulley, col. 17, lines 48 – 64, supplying an additional method of simplifying a complex query).

Levy, Larson '616, Lin, and Paulley are all in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy, Larson '616, Lin, and Paulley before him/her to have further modified the system of Levy with the substitution and replacement of predicates from Paulley, in order to supply an additional method of simplifying a complex query.

As to **Claim 30**, Levy, as modified, differs from the present invention in that it does not appear to explicitly disclose the limitation of: adding the implied predicate to the original predicate and searching for the best solution.

Paulley discloses: adding the implied predicate to the original predicate and searching for the best solution (Paulley, col. 13, lines 1 – 13, and col. 17, lines 48 – 64, supplying an additional method of optimizing a query).

Levy, Larson '616, Lin, and Paulley are all in the related art of query optimization.

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It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy, Larson '616, Lin, and Paulley before him/her to have further modified the system of Levy with the concatenation of predicates from Paulley, in order to supply an additional method of optimizing a query.

16. Claim 32 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Levy, in view of Larson '616 and Lin, as applied to Claim 21 above, and further in view of Reiner.

Levy, Larson '616 and Lin disclose the limitations of Claim 21 for the reasons given above.

As to **Claim 32**, Levy, as modified, differs from the present invention in that it does not appear to explicitly disclose the limitation of: performing a cardinality estimation using at least one of the implied predicate and the equivalent predicate.

Reiner discloses: performing a cardinality estimation using at least one of the implied predicate and the equivalent predicate (Reiner, col. 104, lines 25 – 35, determining the effectiveness of the new predicates).

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Levy, Larson '616, Lin, and Reiner are all in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy, Larson '616, Lin, and Reiner before him/her, to have further modified the system of Levy with the cardinality estimates of Reiner, in order to determine the effectiveness of the new predicates.

17. Claim 33 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Levy, in view of Larson '616 and Lin, as applied to Claim 21 above, and further in view of Leslie, et al., U.S. Pat. No. 5,778,354 (hereafter, "Leslie").

Levy, Larson '616 and Lin disclose the limitations of Claim 21 for the reasons given above.

As to **Claim 33**, Levy, as modified, differs from the present invention in that it does not appear to explicitly disclose the limitation of: creating an index based on an index extension scheme, which scheme includes at least one of, providing a key column of a data type that corresponds to a data type being indexed; providing a set of parameters; and providing a table-valued function name that is used to generate an index entry for a value of the column being indexed.

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Leslie discloses: creating an index based on an index extension scheme, which scheme includes at least one of, providing a key column of a data type that corresponds to a data type being indexed; providing a set of parameters; and providing a table-valued function name that is used to generate an index entry for a value of the column being indexed (Leslie, col. 1, lines 21 – 37, enabling pertinent records to be accessed at a minimum cost).

Levy, Larson '616, Lin, and Leslie are all in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy, Larson '616, Lin, and Lesle before him/her, to have further modified the system of Levy with the indexing scheme of Leslie, in order to enable pertinent records to be accessed at a minimum cost.

18. Claims 35 and 36 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Levy, Larson '616, Larson '415, and Lin, as applied to Claim 34 above, further in view of Pauschine.

Levy, Larson '616, Larson '415, and Lin disclose the limitations of Claim 34 for the reasons given above.

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As to **Claim 35**, Levy, as modified, differs from the present invention in that it does not appear to explicitly disclose the limitation of: means for employing a new ad-hoc exploratory rule for an individual operator of the original predicate.

Pauschine discloses: means for employing a new ad-hoc exploratory rule for an individual operator of the original predicate (Pauschine, col. 18, lines 58 – 67, enabling versatility of rules and predicates).

Levy, Larson '616, Lin, and Pauschine are all the in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy, Larson '616, Larson '415, Lin, and Pauschine before him/her, to have further modified the system of Levy with the employment of ad-hoc rules from Pauschine, in order to enable versatility of rules and predicates.

As to **Claim 36**, Levy, as modified by Larson '616, Larson '415, Lin, and Pauschine, discloses: means for analyzing at least one of the implied predicate and the equivalent predicate with the exploratory rule (Pauschine, col. 18, lines 58 – 67).

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19. Claim 37 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Levy, Larson '616, Larson '415, and Lin, as applied to Claim 34 above, further in view of Paulley.

Levy, Larson '616, Larson '415, and Lin disclose the limitations of Claim 34 for the reasons given above.

As to **Claim 37**, Levy, as modified, differs from the present invention in that it does not appear to explicitly disclose the limitation of: means for requesting a list of tentative substitutes with predicates that involve nested queries; means for including the substitutes into the query to form a new expression; means for simplifying the new expression; means for removing nested queries; and means for generating new alternatives for the search.

Paulley discloses: means for requesting a list of tentative substitutes with predicates that involve nested queries (Paulley, col. 13, lines 1 – 13); means for including the substitutes into the query to form a new expression; simplifying the new expression (Paulley, col. 13, lines 1 – 13); means for removing nested queries; and means for generating new alternatives for the search (Paulley, col. 17, lines 48 – 64, supplying an additional method of simplifying a complex query).

Levy, Larson '616, Larson '415, Lin, and Paulley are all in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy, Larson '616, Larson '415, Lin, and Paulley before him/her to have further modified the system of Levy with the substitution and replacement of predicates from Paulley, in order to supply an additional method of simplifying a complex query.

20. Claim 40 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Levy, Larson '616, Larson '415, and Lin, as applied to Claim 34 above, further in view of Reiner.

Levy, Larson '616, Larson '415, and Lin disclose the limitations of Claim 34 for the reasons given above.

As to **Claim 40**, Levy, as modified, differs from the present invention in that it does not appear to explicitly disclose the limitation of: means for estimating cardinality using at least one of the implied predicate and the equivalent predicate, where use of the implied predicate facilitates defining an upper bound on a number of rows that can satisfy the original predicate.

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Reiner discloses: means for estimating cardinality using at least one of the implied predicate and the equivalent predicate, where use of the implied predicate facilitates defining an upper bound on a number of rows that can satisfy the original predicate (Reiner, col. 104, lines 25 – 35, determining the effectiveness of the new predicates).

Levy, Larson '616, Lin, and Reiner are all in the related art of query optimization.

It would have been obvious to one having ordinary skill in this art at the time of the invention, having the teachings of Levy, Larson '616, Lin, and Reiner before him/her, to have further modified the system of Levy with the cardinality estimates of Reiner, in order to determine the effectiveness of the new predicates.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nirav K. Khakhar whose telephone number is (571) 270-1004. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John R. Cottingham can be reached on (571) 272-7079. The fax phone

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number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Nirav K Khakhar
Examiner
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